Exercise - Antenna parameters

(Resit Ex. 2019-20)

2.a. $EIRP = G_R \cdot G_T \cdot P_{in}$

$G_R = 0\,dBi$ (isotropic)

$G_T = G_T^A \cdot G_{PA} = 15\,dB + 21\,dBi$

$P_{in} = 10\,dBm$ $\quad \therefore EIRP = 15 + 21 + 10 = 46\,dBm$

2.b. Required $P_{out} = -65\,dBm$

Minimum $P_{in} = ?$ | $D_1 = 2\,km$, $\lambda = \frac{c}{f}$, $f = 3\,GHz$

Friis →

$$P_{out} = \left(\frac{\lambda}{4\pi D_1}\right)^2 G_T \cdot G_R \cdot P_{in} \text{ (linear)}$$

$G_T \rightarrow G_{A2} \cdot G_{LNA}$

$G_R \rightarrow G_{A1} \cdot G_{PA}$

(in dB) ↓

$$P_{in} = P_{out} - G_{PA} - G_{A1} - 20\log_{10}\left(\frac{\lambda}{4\pi D_1}\right) - G_{A2} - G_{LNA}$$

$$= -65 - 15 - 21 - (-108) - 0 - 18 = -11\,dBm$$

$$10^{-11/10} = 0.079\,mW$$

2.c.

$G = e_t \cdot D$

$e_t \rightarrow 1/10$

$D = ?$

$G = 0\ dBi$

$\therefore \text{In dB}, \quad D(dBi) = G(dBi) + 10$

$\therefore D = 10\ dBi$

2.d.

$$P_{out} = \left(\frac{\lambda}{4\pi D_2}\right)^2 G_T \cdot G_R \cdot P_{in}$$

$G_T \rightarrow 5\ dBi$

$D_2 \rightarrow 1\ km$

$P_{in} \rightarrow 12\ dBm$

$G_R \rightarrow 18 + 0 = 18$

- Located at the edge of HPBW → loses half the power ∴ Subtract 3 dB

→ pathloss

$= 12 + 5 - 102 + 0 - 3 - 18 = -70\ dBm$

2.e. Multipath scattering and fading effects.